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## Worldwide Prevalence of Head Lice

**To the Editor:** Pediculosis capitis has been well-known since antiquity (1). Human infestation can result in psychological frustration for parents and children (2); furthermore, preventive and therapeutic practices, such as head shaving and the “no-nit” policy of excluding infected children from school, can also induce social stress.

We sought to synthesize the available evidence regarding the worldwide prevalence of lice infestation in the 21st century by conducting a literature search of PubMed and Scopus databases in which we searched for the term *pediculosis*. We also searched Google for the terms *head lice/pediculosis capitis* and individual country names and evaluated references of the articles and reports retrieved through this search. Eligible studies were archived from January 1, 2000, to January 18, 2008.

We retrieved 55 studies (online Technical Appendix, available from [www.cdc.gov/EID/content/14/9/1493-Techapp.pdf](http://www.cdc.gov/EID/content/14/9/1493-Techapp.pdf)). Most studies referred to schoolchildren, but some involved refugees, urban slums, child labor, jails, orphanages, and fishing communities.

Most studies had been conducted in Asia; Turkey was overrepresented. Prevalence varied from 0.7% to 59% and was higher in girls and women. Of the 29 studies, 24 involved schoolchildren; the other studies involved refugee children, child laborers, the general population, street children, jail inmates, and children accompanying their mothers in prison.

In Europe, prevalence varied from 0.48% to 22.4%. However, 1 study reported a much higher annual incidence (37.4%) in England (3). A study in the Ukraine showed increasing adult representation in the overall affected population (4). Six studies involved schoolchildren; the remaining studies

involved refugees, homeless persons, and the general population.

Data from Africa, with the exception of 1 study in South Africa, were derived from Egypt. Prevalence varied from 0% to 58.9% and was higher in females. The study in South Africa (5) challenges the generally accepted concept that head lice infestation refers to lower socioeconomic status; of 2 schools, 1 in a low socioeconomic status area, populated by black students only, and the other in a high socioeconomic status area, populated by students of various races, head lice infestation was found only in the second school, solely among white pupils. Of 6 studies in Egypt, 4 involved diverse populations: urban poor preschool children, orphanage children, and the general population.

Most studies in the Americas were conducted in Brazil, although we also found data from the United States, Cuba, and Argentina. Prevalence varied from 3.6% to 61.4% and was higher in females. Of 7 studies, 4 involved populations other than schoolchildren to some extent: urban slum residents, fishing community residents, adolescents and adults sampled randomly from the general population, elderly nursing home residents, and persons living with repeatedly infested children. A recent study in Brazil (6) noted that prevalence rates determined by visual inspection are twice that of rates determined by hair analysis.

Only 1 study has been performed in Oceania. This study in Australia reported prevalence of 13% and that girls were more likely to have active infection.

Our review shows that pediculosis capitis is widespread throughout the world and does not discriminate on socioeconomic status grounds. The traditional perception of head lice as a parasitosis exclusively associated with schoolchildren of low socioeconomic status is challenged by some of the reports (online Technical Appendix).

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Most studies underestimate overall prevalence by assessing it in a specific timeframe; to the contrary, head lice infestation is a dynamic process that can spread hypergeometrically in closed environments such as schools and in the community (7). The point-prevalence reported by Heukelbach et al (8) may represent a more accurate indicator.

Although socioeconomic status seems to be an indicator of the magnitude of lice infestation, more specific determinants are the dynamic processes of hygienic status and overcrowding. A recent study in Turkey compared 2 neighboring villages with different socioeconomic status. The only factor that was statistically significantly related to pediculosis capitis was size of the household;  $\geq 6$  inhabitants was associated with increased prevalence (9).

Another parameter that may indirectly influence overall prevalence and account for the leveling of the prevalence gradient between rich and poor is awareness of head lice and preventive and therapeutic practices. A study in Australia showed that although parents prefer to play a major role in prevention and treatment, they may lack insight into recent advances and dilemmas regarding these measures (10).

Variations in reported prevalence were found even in data from the same country. These differences can result from surveys being conducted during different seasons, various examination techniques, reporting of active infestation or presence of nits, and potential introduction of effective pediculicides.

Although head lice account for a substantial number of missed schooldays in children, among others, it is surprising that pediculosis capitis is not monitored and prevalence is not regularly reported. Although we cannot extinguish the parasite, effective monitoring and planning will enable us to limit the prevalence and distribution of this parasitosis.

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## Texas Isolates Closely Related to *Bacillus anthracis* Ames

**To the Editor:** Forensic and epidemiologic investigation of the 2001 bioterrorism-associated anthrax attacks used multiple-locus variable-number tandem-repeat analysis (MLVA) to identify the attack strain as Ames (1). Strain identity was essential for subsequent molecular epidemiologic and forensic investigations of this biocrime. To more easily identify this particular strain, comparative whole-genome sequencing (2) and phylogenetic analyses were used to identify single-nucleotide polymorphisms (SNPs) that seem highly specific for Ames strain identification (3). Because *Bacillus anthracis* is a recently emerged clonal pathogen, these SNPs represent highly evolutionarily stable markers (4) that are amenable to many rapid and cost-effective analytical techniques.

MLVA and the Ames-specific SNP assay indicate that the Ames strain has been isolated from nature only 1 time, in southern Texas, USA. Several lineages of *B. anthracis* (5) have been ecologically established in North America. The A.Br.009 clade is the most successful and widely dispersed in North America, but it is not closely related to the Ames

# Worldwide Prevalence of Head Lice

## Technical Appendix

Table. Worldwide prevalence of head lice infestation\*

Country (reference)	Year	Setting	Definition	Incidence
Asia				
China (1)	2004	Refugee children	NA	43/303 (14.2%)
India (2)	2004	Child laborers in a slum area	NA	72/150 (48%)
India (3)	2002	Public primary-school children	NA	156/940 (16.59% overall; 20.42% girls, 13.86% boys)
India (4)	2002	Jail inmates	NA	15/225 (6.6%)
Iran (5)	2006	Children in 12 public rural primary schools	Detection of nits and/or lice	58/847 (6.85%) (55/407 [13.1%] girls, 3/440 [0.7%] boys)
Iran (6)	2005	Primary-school children	NA	45/1,200 (3.8%); 2/564 boys, 45/636 girls
Iraq (7)	2003	409 children from 2 primary schools in Baghdad with different school environment and hygienic status	NA	48.9% incidence in the school with lower school environment and hygiene status. 9.4% in other school
Israel (8)	2001	Children 7–10 years of age	Visual examination and combing; detection of nits and/or lice	152/268; (56.7% overall; 61.2% girls, 36.7% boys)
Jordan (9)	2000	Elementary public-school children	Detection of nits and/or lice	338/2,519 (13.4% overall; 14.5% girls, 11.1% boys)
South Korea (10)	2003	Kindergarten and primary-school children	NA	435/7,495 (5.8% overall; 11.2% girls, 0.9% boys)
South Korea (11)	2000	Kindergarten and primary-school children	Detection of nits and/or lice	294/2,288 (12.8% overall; 23.5% girls, 3.9% i boys)
Malaysia (12)	2006	11-year-old schoolchildren	Fine-tooth combing and visual examination; detection of nits and/or lice	162/463 (35%)
Nepal (13)	2004	A sample of persons 10–39 years of age, street children	NA	16% 59%
Nepal (14)	2004	Urban schoolchildren	NA	172/ 818 (21%)
Palestine (15)	2006	Primary-school girls, 6–14 years of age, from rural and urban area	Detection of nits or lice	340/2,408 (14.1%) with lice 843 of 2408 (35%) with nits
Saudi Arabia (16)	2006	Urban female schoolchildren from private and preparatory schools	NA	116/2239 (5.2%)
Sri Lanka (17)	2001	Children accompanying their mothers in prison	NA	10%
Taiwan (18)	2001	Students	NA	615/5121 (12%)
Taiwan (19)	2000	Primary-school children (12.9%) from 4 rural districts and 1 urban area	NA	391/3029; More common in rural areas and among girls
Turkey (20)	2007	Schoolchildren	Visual inspection	31.1% in a low socioeconomic–status village, 7.7% in a neighboring higher socioeconomic status village (69 and 31 children, respectively)
Turkey (21)	2007	Deaf students	NA	6/117 (5.1%)
Turkey (22)	2006	Schoolchildren	Visual inspection	9/1134 (0.8%)
Turkey (23)	2006	Primary-school children	NA	20/68 (29.4%); 0/32 (0%) boys, 20/36 (55.5%) girls

Country (reference)	Year	Setting	Definition	Incidence
Turkey (24)	2006	Primary-school children	Detection of nits and/or lice	117/1261 (9.1%); 16/648 (2.1%) boys, 101/613 (16.4%) girls
Turkey (25)	2006	Rural primary-school children	Nits (no adult lice detected)	17/178 (9.5%); 2/104 (1.9%) boys, 15/74 (20.3%) girls
Turkey (26)	2005	Schoolchildren 7–14 years of age	Visual examination; detection of nits and/or lice	260/1569 (16.6% overall; 31.8% girls, 2.5% boys)
Turkey (27)	2003	Elementary-school children	Detection of nits and/or lice	360/5318 (6.8% overall; 13.3% girls, 1.1% boys)
Turkey (28)	2003	Schoolchildren	NA	701/20612 (3.4%)
Turkey (29)	2002	Primary-school children	NA	74/785 (9.4%)
Europe				
Albania (30)	2002	Refugees from Kosovo (479,223 officially registered)	NA	≈4%
Belgium (31)	2005	Schoolchildren 2.5–12 years of age	Wet combing	549/6169 (8.9%)
Belgium (32)	2000	Primary-school children in a socially deprived urban area	Visual examination and combing	49/224 (21.9%)
Czech Republic (33)	2006	Schoolchildren 6–15 years of age	Dry-hair combing; detection of live lice or dead nits.	75/531 with lice (14.1%) 52/531 with nits (9.8%)
England (34)	2003	Primary-school children	NA	438/21556 (2.03%); annual incidence 37.4%
England (35)	2003	Diagnosis of pediculosis in the West Midland population from 1993-2000	NA	28.2/1,000 patient years at risk
France (36)	2007	Urban primary-school children	Fine-tooth combing. Detection of live lice	112/3345 (3.3%)
France (37)	2005	Homeless persons	NA	205/930 (22%)
Kosovo (38)	2000	Kosovar refugees upon arrival in the United States	Detection of nits and/or lice	107/1051 (10.2%)
Poland (39)	2004	Rural schoolchildren, urban schoolchildren	NA	682/42759 (1.59%) 252/52394 (0.48%)
Ukraine (40)	2006	Population of Ukraine 1990–2004	NA	Referenced as endemic, no actual data shown. Predominance of children in the total infected population in 1990 roughly equal infestation of adults and children in 2004
Africa				
Egypt (41)	2003	Rural inhabitants of all ages	NA	1551/8008 (19.37%)
Egypt (42)	2002	Population sample	Visual examination	137/2448 (5.6%)
Egypt (43)	2001	Primary-, preparatory-, secondary- school children	NA	384/1772 with head or body lice (21.67% overall; 30.26% girls, 17.7% boys, 18.2:1 head lice:body lice ratio)
Egypt (44)	2000	Urban poor preschool children	Visual examination	151/ 256 (58.9%)
Egypt (45)	2000	Orphanage children 2–6 years of age	NA	64.1%
Egypt (46)	2000	Primary-school children	NA	276/510 (54.1%)
South Africa (47)	2003	Primary-school children 6–13 years of age (black and white) from 2 rural schools, 1 with low and 1 with high socioeconomic status	Visual examination followed by hair conditioner and fine-tooth combing if evidence of lice found; detection of nits and/or lice	0/300 (0%) in the school with low socioeconomic status; 15/175 (8.6%) in the other school; all infected children were white
Americas				
Argentina (48)	2005	Primary-school children from public and private school	Detection of nits and/or lice	842/1370 (61.4%); 296/678 (44%) boys, 546/692 (79%) girls

Country (reference)	Year	Setting	Definition	Incidence
Brazil (49)	2007	98 children, 196 adolescents, 119 adults, 90 elderly nursing home residents	Cut hair analysis and visual inspection	13.3%, 5.6%, 5.4%. and 5.5% respectively, by cut hair analysis. Visual inspection doubled this prevalence in general
Brazil (50)	2005	Urban slum residents, fishing community residents	NA	634/1460 (43.4%); 170/605 (28.1%)
Brazil (51)	2003	Slum population attending a primary healthcare center	NA	Point prevalence 38.2%
Brazil (52)	2002	Children 0–15 years of age at day care centers; public, urban, rural schools	NA	309/884 (35%)
Cuba (53)	2000	Persons living with children who repeatedly had pediculosis	NA	40/237 (14.54% overall; 82.5% female)
United States (54)	2001	Students	Detection of nits or lice	28/1729 (1.6%) with lice 63/1729 (3.6%) with nits without lice
Oceania (Australia) (55)	2004	Primary-school children	Hair conditioner and fine-tooth combing; detection of nits and/or lice	239/1838 (13%); girls more likely to have active infection

\*NA, not available.

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